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The Creative Workman

An Address Delivered Before The Technical Association of the Pulp and Paper Industry at the Spring Meeting, held at Dayton, Ohio, May 16, 1918

By ROBERT B. WOLF,
Manager, Spanish River Pulp and Paper Mills, Ltd.
Sault Ste. Marie, Ontario, Canada

Technical Association of the Pulp and Paper Industry
117 East Twenty-fourth Street
New York

1918

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The Creative Workman

Use of Individual Progress Records as a Means of Making Work Interesting and Enjoyable

By ROBERT B. WOLF

Manager, Spanish River Pulp and Paper Mills, Ltd., Sault Ste. Marie, Ont.

MODERN industry has to a great extent made life in our large manufacturing plants almost unbearably mechanical. As a result, the workmen are in many cases in open rebellion against the entire system. The trouble arises clearly from a lack of realization of what human life is for. Therefore, an analysis of the qualities in work which attract or repel us would surely be most helpful and, if carried far enough, should reveal something of the meaning of life and of the individual's relationship to his whole environment.

The success we have had in making the work of our paper machines interesting and therefore attractive to our machine operators will, I feel sure, prove helpful to others who are endeavoring to solve the individual problem. At any rate, it is a great pleasure to us to see how our men are beginning to enjoy work which, before the introduction of progress records, was not particularly attractive. The philosophy underlying our experience is, of course, not in any sense confined to the paper industry, and from previous experience I know can be widely extended. No philosophy of life, however, is valuable, unless it is capable of practical application, so I hope the illustrations which follow will prove to be of real value as a concrete demonstration of the principles involved.

The development of this philosophy was based upon results obtained in The Burgess Sulphite Fibre Company's mills at Berlin, N. H. There we were making sulphite pulp with its accompanying by-products, and had recorded almost all the operations in the process. We had, however, no experience in that plant with the recording of operations on paper machines, so when we started our work at the Sturgeon Falls plant of The Spanish River Co., we decided to undertake this investigation, especially as we were having considerable trouble with uneven weights of paper. We determined to go at this problem from the *quality* basis, as our experience at the "Burgess" plant had been that the quality records were the most important. *Quantity* records we found usually tended to make hard feeling among the men, as many of you have probably observed, where one machine crew disputes with another because of a difference of opinion as to who should be credited with a roll at the end of the shift. I found that the international officers of the Paper Makers Union felt very much the same way about it and were inclined to be instinctively opposed to the posting of production records. Quality records, however, are of a different nature, as they bring into play the reasoning, thinking power of man much more than quantity records; the latter reflect the physical side of his nature rather than the intellectual side. Wherever the competition is on a quality basis, cooperation results, and cooperation of this nature does not diminish the spirit of emulation but on the contrary tends to strengthen it.

Before referring to the illustrations which show in concrete form our results, I believe it will be helpful to review our general philosophy of management. I sincerely hope what I say will be looked upon as simply my own interpretation of the facts as we have observed them, and even though I may seem to be dogmatic at times, that you will be indulgent and consider this as possibly an inherent defect of any individual interpretation of a vital process. I feel that our experiences stand out only as so many isolated and disconnected fragments unless we are able to connect them by a process of reflection into a philosophical concept. It is this concept of a law or principle which we can pass on to others, and it is useful in proportion as it is practical. If it does not fit into the general scheme of life it is not worth our serious consideration. On the other hand, if it does prove its practical value, its presentation adds something to the sum total of human happiness. It is with this thought in mind, therefore, that I am taking the liberty of weaving a philosophy of management around the concrete facts of our paper machine operations.

The basic principle of our philosophy is that a man must be interested in his work in order to get good results. If he is not interested, he will not do his best. He is simply in this case reacting to externally applied force or stimulation, and is doing his work more because he is compelled to do it, from fear of either losing his job or being penalized in some way. A man in this frame of mind cannot do his best work and will really do as little as possible. If the work is interesting, however, he works "from within out" as it were, because he *desires* to do so and not because someone is all the time "following him up." This type of worker is what we call the *creative* type and a plant is successful in direct proportion to the number of men that it has of this type.

Is the discontent and restlessness in and around our great over-specialized industrial plants (in spite of their so called welfare work) not due to the fact that the creative impulse of the worker has no chance to develop in them? Efficiency it seems to me has too often been made an end in itself to be attained at all costs regardless of individual wellbeing. In many of our mills and factories men are used simply as intelligent machines and are given no opportunity to use their thinking powers. Regardless of how seemingly well operated a plant of this kind may be, how can it even approach a maximum of good results if 95 per cent of its employees are not permitted to use their brains in their work? Does this form of industrialism differ very materially from that of the older mediæval form of industrial slavery which Germany has so *efficiently* brought up to date? It is no accident that practically the entire working world is willing to make untold sacrifices to crush out this giant organization which seeks to dominate by repression, and it seems to me that the only way that we can avoid a deadlock in this present war is to concentrate our efforts to organize without repression and remove from the face of the earth forever the pernicious doctrine of the "divine right of kings." This war has

been called an industrial war — a war of machine power. If this is so, how long can Germany hold out when she is using only about 5 percent of her people in creative work? If we have the intelligence to organize our industries so that ten times this percentage are using their brains, we can set in motion such intensely powerful forces that the German machine will be absolutely unable to withstand them. Can this be done? I believe our experiences show that if granted their undeniable right to work intelligently, even a larger percentage than the 50 percent suggested above will do creative work.

As an indication of the low percentage of creative power used by the Germans, I will cite two industries which are typical. Over two years ago one of the directors of a great transatlantic steamship corporation told me that in twenty years to his own knowledge no basic invention in shipbuilding had come out of Germany. They have analyzed and refined what others have created but that is all. The same is true in the steel and iron industry, so I was informed a few days ago by the head of one of America's greatest steel corporations.

We recognize in our work three fields of operation. The FIRST we may call the "field of nature," and such sciences as chemistry, physics and mechanics record the operations in this field. All that these sciences do is to organize the observed facts in the physical world and by means of this organization record the laws of the various physical elements which make up the raw materials. The laws of the raw materials and the effects of the various manufacturing processes upon these raw materials must be recorded if we are properly to enlist into the service what we recognize as the SECOND great field of industrial operation, namely, "the will of man."

The realm of so called "exact science," does not extend to this field. It is only in proportion as we are able to give to man the greatest possible amount of knowledge of the first field and to create conditions where he can use this knowledge in constructive, imaginative work, that good results are obtained. It is beginning to be recognized today that we cannot drive men to do work against their will and obtain anything like the best operating conditions in our plants. The thing that a man does unwillingly he is not interested in and will not do well; neither will he do good work if he is indifferent as to whether the work is well performed or not. The problem is how to produce a desire upon the part of the workman to do the work for its own sake. Our experience has shown that this can be done when conditions in the plant permit him to use the creative power of his intellect and thereby become the conscious director of the natural forces that he is using. It is not only necessary, however, to give this originating, choosing and adapting power of the intellect a chance to operate, but if we are to invoke it to the greatest degree, we must record—insofar as it is practical—each man's progress. The progress record, as indicated by the score, is the thing which makes a game interesting and the pleasure we derive from a game comes largely from the consciousness that we are matching our own intelligence against the other man's intelligence. It is for this reason that in quality records we get, exactly as we do in games, a spirit of fair play and friendly competition, rather than the hard unfriendly feeling which comes when the records are mainly those of production or quantity only.

The THIRD field has to do with the "spirit of unity" in the organization which men call *esprit de corps*. It is invoked largely through teaching each man his part in the organization by enabling him to become conscious of the effect of his acts upon every other part of the organization. It is not enough to teach a man his own work well and to create an environment in which he can obtain the best results on his own job, but he should realize the effect of his work on every part of the organization and, therefore, his relationship to the whole. It is, of course, largely the function of the executive branch consciously to develop this spirit of unity, but this spirit must be developed if the best results are to be obtained.

In Philadelphia a few days ago, I heard the head of one of our large shipbuilding corporations, when asked how he got such splendid results in his plant, reply that 80 percent of the results were due to the spirit of the men. He added, however, that this spirit is largely emotional and therefore apt to change suddenly. It is this very spirit of enthusiasm which, if properly directed, overcomes all obstacles, and the great problem in management is how to develop it rationally and in constantly increasing proportion. What I hope to point out to you today is that if we are to perpetuate this spirit, it will be by showing how these strong emotions can be controlled by the mind through the use of the intellect and that if we intelligently build up in our plants many individual progress records, which not only inform each man of his own progress but also of the effect of his work on others working with him, we will have something tangible which men can recognize as the result of their unfolding spiritual consciousness, which is the mainspring of every one's activity. I do not mean by this that all of our activity should be purely intellectual, but that by the use of the intellect we must learn to control our emotions if the great power stored up in the emotional nature is to be used in constructive work for the advancement of the human race. Instead of poking fun at anything intellectual, why not get over this prejudice by recognizing the intellect as simply the instrument used by the mind? What we all do is simply to select from our outer experiences (the field of our activity) what it is we wish to leave our impression upon; then by the use of our *in*telligence (intellect) we make up our minds what course to follow. This is no "high brow stunt," but just plain commonsense.

It is necessary, if an industry is to make genuine progress, that a real science of the industry be built up. So far we have been very largely concerned with the art of making paper and not with the science. I am afraid that we have forgotten that we can only have a great art where the organized facts, which record the science, are so complete and comprehensive that the individual who wishes to express this art can master the laws as recorded in the science. As it has been so well expressed by A. F. Sheldon, "Science is organized facts," and "Art is a science practised," so that unless we can organize the facts underlying the industry—the chemistry, physics and mechanics of the process—it will be impossible for the men in the industry properly to express the art. The art, however, must be expressed not only through the emotions but also by the mind through the use of the intellect.

Is not the reason it has taken so long to learn a trade, in the great majority of cases, that there is no science of the trade where a man can study the natural

Association
1918

THE CREATIVE WORKMAN
REEL RECORD

TOUR NO. 1 MACHINE NO. 1 MACHINE TENDER BENNETT DATE Oct. 16 191

TIME	REEL	UNIFORMITY RECORD 1	2	AVE	WEIGHT OF SAMPLES 1	2	3	4	5	TOTAL WEIGHT REEL AVERAGE	AVERAGE FOR DAY	WEIGHT RECLOTHED PER REEL RECORD	AVERAGE FOR DAY	PER CENT MOISTURE RECORD ROLL	REEL	AVE	MOISTURE RECORD REEL	AVE			
8 20	1	30.0	90.0	60.0	30.25 28.50	29.00 27.50	29.75 27.00			29 50 29 50	29.50	50.0 50.0	50.0	7 3 6 1 6 2	6 5 6.5	6.5	62 5 62 5	62.5	37 35 34	35 35	
9 00	2	70.0	60.0	65.0	33.25 30.50	32.50 30.00	34.25 31.50			33 33 62 83	31 41	74.0 124.0	62.0	8 3 7 7 8 1	8 0 7 5	7.2	100 0 162 5	81.2	41 40 33	38 73	36
9 40	3	70.0	100.0	85.0	30 75 29 00	30 00 28 00	33.00 28.00			30 25 93 08	31 02	66.0 190.0	63.3	5.7 6.7 6.7	6.4 20.9	7.0	60.0 222.5	74.2	30 31 34	32 105	35
10 20	4	100.0	50.0	75.0	30.25 28.25	29.00 27.50	30.25 28.50			29 83 122 91	30 73	56.0 246.0	61.5	6.6 5 2 5 9	5.9 26.8	6.7	47 5 270.0	67.5	34 34 32	33 138	35
11 05	5	70.0	90.0	80.0	31 75 29.75	30.75 29.75	31.00 29.50			31 17 154 08	30 82	84.0 330.0	66.0	6.3 6 5 4 8	5.9 32.7	6.5	47 5 317 5	63.5	33 30 32	32 170	34
11 45	6	50.0	80.0	65.0	32.50 30.25	31.25 29.50	30.75 29.00			31 50 185 58	30 93	92.0 422.0	70.3	6 0 6 6 5 7	6 1 38 8	6 5	52 5 370 0	61 7	36 34 29	33 203	34
12 20	7	100.0	50.0	75.0	32 25 30.00	31.00 28.50	31.25 30.00			31 83 217 91	31 06	96.0 518.0	74.0	7.0 8 1 7 0	7 4 46 2	6 6	85 0 435.0	65.0	33 31 30	31 234	32
12 55	8	90.0	80.0	85.0	31.75 29.50	31.00 29.00	31.50 29.50			31 42 248 83	31 10	88.0 606.0	75.7	7 1 6 4 6 3	6 6 52 8	6 6	65 0 520.0	65.0	34 31 30	32 266	33
1 35	9	90.0	90.0	90.0	30.25 28.50	30.75 28.50	30.50 28.50			30 50 279 33	31 09	70.0 676.0	75.1	5 8 7 3 6 5	6 53 3	6.6	62 5 582 5	64.7	33 31 30	31 297	33
2 05	10	70.0	80.0	75.0	32.75 30.50	31.50 29.50	32.00 30.00			32 08 311 41	31 14	98.0 774.0	77.4	6 9 6 3 6 3	6 5 63 8	6.6	62 5 645.0	64.5	34 35 30	33 330	33
2 55	11	70.0	80.0	75.0	33.25 30.50	32.00 29.75	32.50 30.25			32 58 343 99	31 27	88.0 862.0	78.4	8 3 7 0 6 9	7 4 73 2	6 7	85 0 730.0	66 9	31 32 30	31 361	33
3 40	12	60.0	90.0	75.0	31 75 29 75	30.50 28 75	30.75 29.00			31 00 374 99	31 25	80.0 942.0	78.5	6 2 5 8 5 7	5 9 79	6 6	47 5 777 5	64.8	32 35 38	35 396	33
	13	Total		905.0																	
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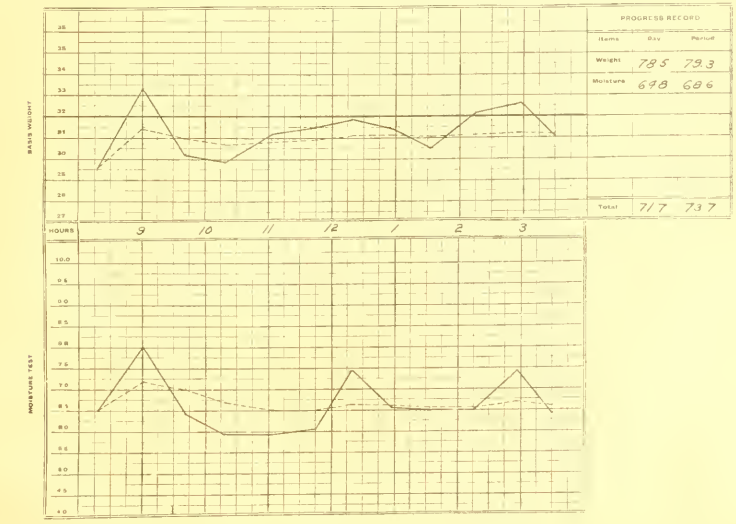
TOUR NO 1 MACHINE NO 1 MACHINE TENDER BENNETT DATE Oct. 16 191 7



PROGRESS RECORD

Items	Day	Period
Weight	79 5	79.3
Moisture	6.98	6.86
Total	7.17	7.37

laws of the process. In most trades the workman must see everything actually happen before he can tell what to do in an emergency and this of necessity takes a long time. It is the length of time required for a man to develop himself into an all-round craftsman that is, perhaps, one of the main reasons why the employer has resorted to those methods of extreme specialization which the workmen are certainly justified in resenting.

The trade school movement, as it is developing in this country, gives great promise of correcting the evils of the present system of education which in the past has taken so little account of the practical arts.

With us the movement is the direct opposite of the Prussian system which fits the man into a predetermined place in the industrial machine, for our system aims to help him find the kind of work *he* desires to do and is best fitted for. In the past the industrial system has been mainly used to exploit men and this misuse of the industrial organization has perhaps been largely responsible for the apparent failure of the democratic form of government. The great problem is how to unite men without crushing them, and the answer to this problem will not come from the politicians and lawyers, but from those who are masters of material forces and therefore know the law. We are to recognize at last that the real reason for the existence of industry is to form a field for the development of the human race.

We should begin to look upon our industrial institutions as primarily educational in nature; for education does not consist simply in the acquiring of facts by a process of accumulation and then making no use of them. Real education is not only proper nourishment of the mind, but proper use of the mind; in other words, there must be *ex*pression as well as *im*pression.

So it seems to me that if we look at our industrial institutions from this point of view we will see that the process of education is continuous throughout life, as indeed it should be, for it not only means equality of opportunity for all but knowledge of individual capacity which is more important still. The old idea that education ends with our graduation from school or college, has to be replaced by the saner conception that this preliminary training really only stimulates a desire for knowledge by furnishing us with a means for knowing how to acquire more knowledge.

Some of our so-called learned men exhibit the least amount of intelligence and therefore in reality have the poorest education. A man does not have to be a college man or a high school graduate to be educated. In fact some of our greatest scientists have never been to college. They obtained their education in the school of life. Any man who keeps an open mind, free from prejudice, and is intelligently inquiring into the reason why things happen as they do, is educating himself. He is studying nature's forces in action, and, if he intelligently inquires why they act naturally as far as they do, he will learn how to create the special conditions to make them go further. It was because man observed things which floated in a natural way that he was able to discover the law that "anything which bulk for bulk was lighter than the water it displaced would float." He was then able to begin the organization of the facts which make up the science of shipbuilding. He now makes iron float by the use of the very same law by which it sinks. We can see then how man, by the use of his intellect, creates a set of conditions which do not occur spontaneously in nature—nature serves him in proportion to his knowledge of her laws an education is nothing more or less than obtaining a knowledge of natural law.

We are wasting one of the greatest oportunities for the development of the human race when we so design our industries that a man ceases to consciously accumulate experiences and simply becomes an automaton in the performance of his day's work. When we recognize the fact that the intelligence of an institution is but the sum of the intelligences of its individual members, we will see how absolutely essential it is that we make our main object the development of man power. If the men are right, the plant can not help being right.

The idea that one man can arbitrarily dominate an organization and drive it as he wills is fast giving place to the saner conception that the manager must lead and not drive, and he is successful in proportion as he encourages those entrusted to his charge to work out things for themselves. He must learn to delegate authority and not try to hold it all in his own hands. Why not, therefore, recognize the fact that, if it is necessary for the manager to throw responsibility upon his superintendents, department heads and foremen, it is equally necessary to place responsibility upon the individual worker as well? Contrary to the commonly accepted impression, it has been our experience that men crave responsibility. My own belief is that no stable form of society will be secured until our industries are so designed that workmen feel this responsibility. They can become responsible members of society only when they are responsible members of industry, for the obvious reason that the unthinking man is not a responsible man.

My personal feeling is that the main reason why labor organizations have been formed is to prevent the exploitation of their members. Men do not want to be made into machines and the reason there is the constant demand for shorter hours and more pay is that men desire to get away from the deadening sameness of the work which is destructive to individuality. They feel that the trend of modern industry is more and more to make automatons of them and that this tendency is inevitable. Therefore, the only possible chance for individual development of the men is outside of the mere routine of the workshop. They forget, however, that the work by which man lives must in the very nature of things furnish him with an opportunity for self-expression and that if the element of joy in work is lacking from his daily task, the man's life will be anything but full and complete (as it is destined to be). It is only when employers recognize this condition and earnestly strive to remedy it, that there will be any relief from the present industrial unrest. It might be proper to explain right here that I did not reach this conclusion by reading books on philosophy or political economy, but by actual contact with the men. I have had twenty-two years experience as both workman and employer and have talked with men individually and collectively through our labor organizations, and invariably when I mention making the work interesting and enjoyable the suggestion is welcomed with enthusiasm.

While men must be fully paid for the services they render and must have sufficient time for recreation and leisure, it is nevertheless true that shorter hours and more pay by themselves will not solve our labor problems. Joy in work is equally essential, and this

cannot be made real unless the workman has an opportunity to learn to express consciously that which is unique and individual within himself.

Before giving you actual illustrations I would like to explain the causes leading up to our decision to keep these records. In the first place, the publishers are very particular about the weight of the paper they use. A ream 24x36—500 sheets—should weigh exactly 32 pounds, as this is the standard weight for newspaper. If the paper runs lighter than this, it is apt to cause breaks in the pressroom and if it runs heavier, a publisher will not be able to get as many editions out of a ton and his paper cost will increase in proportion. It is also true that if the paper is overdried on the machine it becomes brittle and, therefore, breaks easily in running over the printing press. In addition, the dryness makes it impossible for the sheet to take a good finish and as a result the surface will "fuzz up" and fine particles will come off on the type of the printing presses and cause trouble, especially with the cuts, by filling up the fine corrugations or meshes. Therefore, the main problem is to make an absolutely uniform weight of paper, which has a good finish and at the same time elasticity without the objectionable fuzziness.

In the ordinary course of events, the publisher makes a vigorous complaint to the sales office who will pass the complaint along to the manager's office. We then take the matter up with the superintendent and he in turn passes the "kick" along to his assistant, who passes it along to the boss machinetender, until it finally reaches the machinetender or backtender or any member of the crew who is responsible. Things will go along fairly well for a time and then the process is repeated and each time we have to think of a new way of expressing the same old "kick." We made up our minds, therefore, that the trouble was due largely to a lack of interest on the part of the men operating the machines in keeping the operating conditions where they should be to eliminate complaints, and that this lack of interest came largely from their lack of knowledge as to what the conditions actually were; in other words, there were not enough samples taken of the sheet as it was operating on the machine to inform the machine crew of what was occurring. The ordinary method is for the backtender to take a sample off each reel, and weigh it and let the machinetender know the results. The machinetender then turns on or shuts off stock according to whether the sample is light or heavy. A sample from the front, middle and back of the sheet is taken occasionally, but as a rule not as often as it should be in order to get the most uniform results. Realizing that the problem was to produce a desire upon the part of the machine crew to get the results we were after, we put on to each shift, a man (one for every two machines) whose duty it is to take a sample every time a reel is changed (once in every 30 or 40 minutes), from the front, middle and back of the sheet. These three samples are weighed and recorded as indicated on the form shown on Plate 1, reproduced herewith.

These forms, which are kept in the machine room, are filled in by the "sample tester," who needs to be a good, bright, intelligent young fellow, quick and accurate with figures. While these men are instructed in the work by the research department, they are largely recruited from the machine crews and in our mills are members of the labor unions. There is no thought in the minds of our men that this is a "follow-up" system designed to enable the management to find fault with the workman. They recognize it to be a system to help them get information which they would not have time to get themselves and which they must have in order to do their work more intelligently. As you will soon see, we are recording the facts which enable all of us to recognize the natural laws underlying the process.

The first column marked "Time" shows when the sample was taken (at the change of the reel). The second column gives the continuous reel numbers for the shifts (the process is continuous three 8-hour shifts in twenty-four hours). The next column was designed originally to "tie up" the reel number to the numbers of the rolls made from each reel in order to enable us to trace responsibility for complaints, but as the uniformity of results obtained later made this unnecessary, we abandoned its use and used this column to record the "Uniformity Record," which will be explained later.

The next main column marked "Weight of Sample" shows under the headings 1, 2 and 3 the weight of the samples of paper taken at the front, middle and back of the sheet, respectively (taken across the machine). On our medium-width machines at Espanola we planned to take four samples and on the wide machines at the "Soo" five samples instead of only three as on these narrow machines at Sturgeon Falls; hence the reason for the five columns.

The first entries on the upper line are the exact weights (on a ream basis) of each of the three samples taken, and the first entry under the main column headed "Total Weight" is the average of the three samples. All of the other figures in the "Total Weight" column explain themselves. It is only necessary to remark that they are for the purpose of determining the average weights and weights to date for the shift.

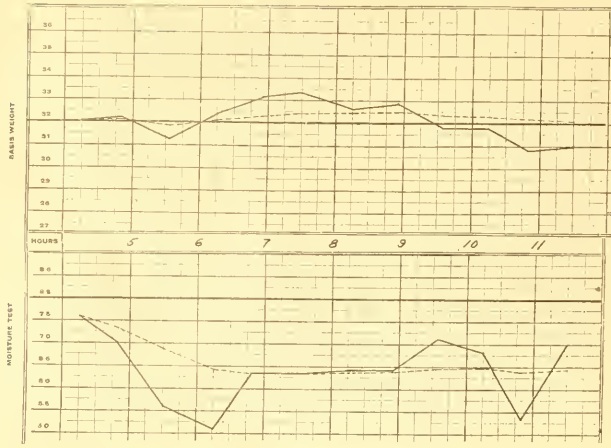
These figures are plotted on the chart at the bottom of the sheet marked "Basis Weight," and thereby enable the machine tender to visualize quickly what he is doing. The 32lb weight is drawn in as a heavy line so a quick comparison with the ideal standard can be made.

Before explaining the other figures on the chart, it is necessary to tell you the facts leading up to their inclusion in our records. When we first talked with our men about recording the "basis weight" in this way, they called our attention to the fact that the record of basis weight alone would not be sufficient; that the moisture in the sheet should also be recorded. Our research department then worked out the details of the plan, but the most valuable suggestions came from one of the international officers of the Paper Makers' Union. We built a small drying oven which was placed close to the work table where the sample cutter and scales are located, and as soon as a sample is weighed it is marked and immediately placed in this oven and dried to bone-dryness. (This takes about 10 minutes.) It is again weighed and the figures entered in the "Weight of Sample" column just under its original weight. From a direct reading table, it is easy to compute the moisture test of each sample which is entered in the "Percent of Moisture" column under "Roll." The average of the three is entered under "Reel." The average to date for the shift is then computed exactly as in the case of the "Total Weight" column.

This moisture test is then plotted on the bottom

1

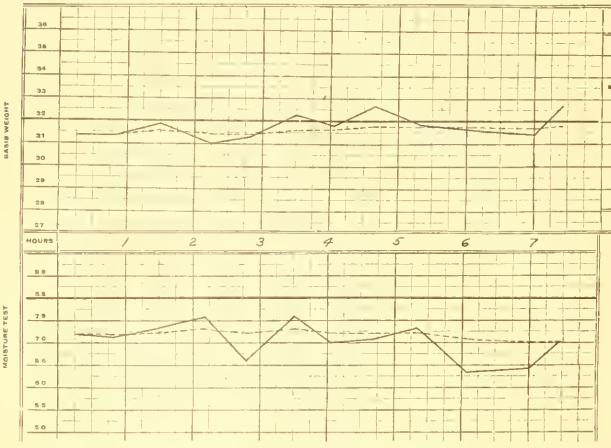
TOUR NO. 2 MACHINE NO. 1 MACHINE TENDER SAWYER DATE Oct. 16 191 7



PROGRESS RECORD		
Items	Day	Period
Weight	85.1	85.0
Moisture	60.0	67.6
Total	72.6	77.8

2

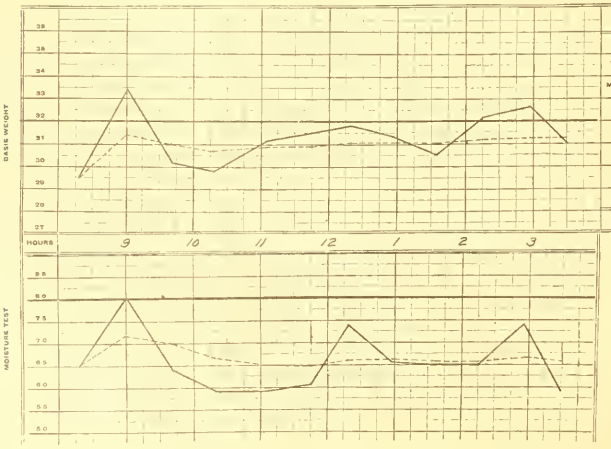
TOUR NO. 3 MACHINE NO. 1 MACHINE TENDER TAYLOR DATE Oct. 16 191 7



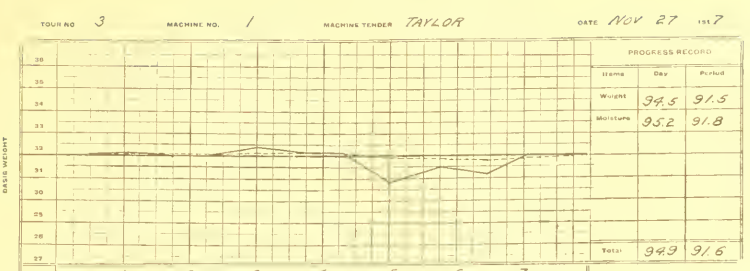
PROGRESS RECORD		
Items	Day	Period
Weight	90.0	82.1
Moisture	74.3	72.7
Total	82.2	76.2

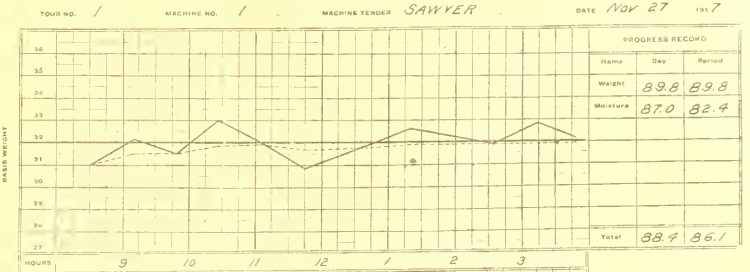
3

TOUR NO. 1 MACHINE NO. 1 MACHINE TENDER BENNETT DATE Oct. 16 191 7



PROGRESS RECORD		
Items	Day	Period
Weight	78.5	79.3
Moisture	64.8	68.6
Total	71.7	73.7


TOUR NO. 3
MACHINE NO. 1
MACHINE TENDER TAYLOR
DATE NOV 27 1917
PROGRESS RECORD
Items | Day | Period
Weight | 94.5 | 91.5
Moisture | 95.2 | 91.8
Total | 94.9 | 91.6
BASIS WEIGHT
HOURS
1 2 3 4 5 6 7
MOISTURE TEST


TOUR NO. 1
MACHINE NO. 1
MACHINE TENDER SAWYER
DATE NOV 27 1917
PROGRESS RECORD
Items | Day | Period
Weight | 89.8 | 89.8
Moisture | 87.0 | 82.4
Total | 88.4 | 86.1
BASIS WEIGHT
HOURS
9 10 11 12 1 2 3
MOISTURE TEST

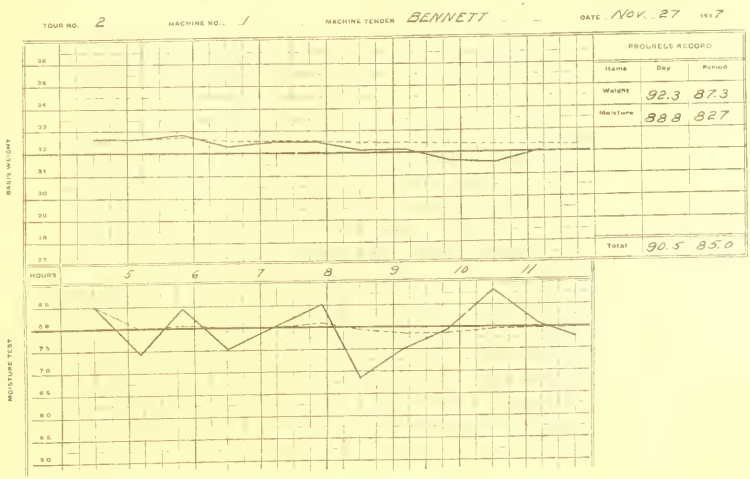

TOUR NO. 2
MACHINE NO. 1
MACHINE TENDER BENNETT
DATE NOV. 27 1917
PROGRESS RECORD
Items | Day | Period
Weight | 92.3 | 87.3
Moisture | 88.8 | 82.7
Total | 90.5 | 85.0
BASIS WEIGHT
HOURS
5 6 7 8 9 10 11
MOISTURE TEST

PLATE III

chart sheet marked "Moisture Test." This, of course, proved to be a wonderful help to the back tender, whose work it is to regulate the steam pressure on the drying cylinders. Before this plan to give the exact moisture test was put into execution, the only way the backtender could tell anything about the moisture content of the sheet was to "feel" it as it passed from the calendar stack to the reel. Of course, no record of this "feel" could be made to enable the backtender to tell how well his work was being done, so there was no particular reason why he should be interested in this part of his work. It is only the exceptional man who has imagination enough to create within himself a consciousness of his progress.

Now this brings me to the "Weight Record" and "Moisture Record" columns. Our view is that every man is entitled to know how well he is doing his work and that it is one of the great moral obligations of the management to furnish him with a means of recording his progress. Aside from the satisfaction it gives the workman it is also a means of eliminating favoritism from the plant, for each man's record speaks for itself. The modern industrial plant with its specialization of functions, where each man does only a fractional part of an operation, no longer allows the operator to leave the impress of his personality upon the work itself. In the old days when the workman made the complete finished article, it literally reflected his individuality, and being a creation of his own mind, he found joy in its production. The desire for self-expression, which is the most fundamental instinct in life, had been gratified through the creation of the article produced.

We must either accept the illogical premise that the combining of men into large industrial production units is contrary to the natural law of life, or we must squarely face the fact that this creative instinct, which the old order satisfied, must be permitted in the new. At first sight this may seem hopeless, but on further examination we find this not at all to be the case. On the contrary, because of the wonderful advance of modern science which has increased the reasoning power of the human mind to a marvelous extent there is vastly more opportunity for the individual to do creative work. We must, however, begin to study the problem with an earnest desire to solve it, for its solution is the most pressing and vital question before the civilized world today. It is with the hope that these examples will help point a way toward the solution of this problem, that I am offering them to you for your consideration.

My attention was called in a striking manner to the increasing interest taken in the problem by the public generally when in Washington a few days ago. While waiting for a trolley on Pennsylvania avenue a policeman, waiting for the same car, remarked to me that the Capitol was a lively place just now; to which I assented, saying it was perhaps a good thing to wake up the old crowd a bit. This apparently met with his approval, for he admitted that the government employees really took little interest in their work. Upon asking him for his explanation of this, he said—and I am giving it as nearly as I can in his own words—"The reason is, that they don't have a chance to express their individuality in the work, so it doesn't interest them."

I mention this incident to call attention to the circumstance that a great many men are thinking along these lines, and even the policeman is becoming a philosopher.

Man never creates matter or force, but he does through his conscious mind create conditions for the expansion and control of these great primary universal energies, and this creative function has as its instrument the originating, choosing and adapting faculty of the human intellect. Suppress, or rather misdirect it—for it cannot be suppressed—as we are so unthinkingly doing in the world of modern industry, and we are simply turning the "will of man" into forces of disintegration, which will eventually destroy society. The only remedy is so to reorganize our business and social systems that the creative power residing in the "will" can become constructive and therefore cooperative with the great natural laws of evolution.

The trouble with the average employer is that he has been so engrossed in the task of creating an efficient organization to express his *own* individuality that he has entirely overlooked the fact that in the creation of this thing he has forgotten to extend the same privilege to his employees. If he only stops to think of it he will recognize at once that he cannot hope to get the initiative of the workman except by giving him a similar privilege of seeing his own creations grow, either by leaving the impress of his personality upon the article produced or upon the progress record of his work.

The workman has combined against the employer in order to obtain the freedom which he sees steadily being taken away from him, as industry tends more and more to make automatons of men; and the unfortunate part of it all is that he has accepted in all too many cases the premise that this tendency is logical and, therefore, inevitable.

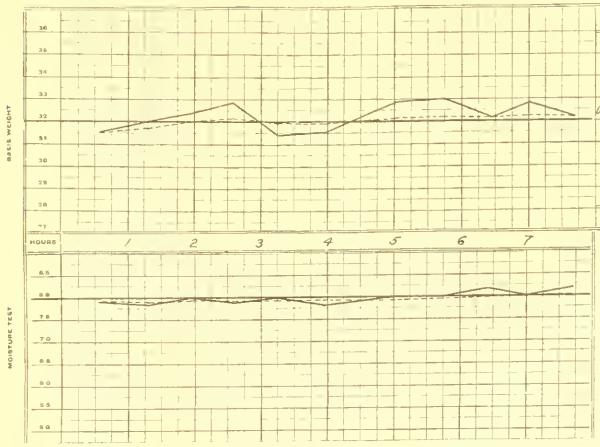
The ideal of some labor leaders inclining toward the socialistic philosophy is that man should be able to produce in a few hours each day all he needs to support himself and his family, and will then have the rest of the day to do as he pleases.

This idea has been strengthened undoubtedly by the workmen seeing men who apparently do little or no productive work, profit out of all proportion to their efforts. Does the remedy not lie in, first, correcting the laws which create special privilege; and, second, in making our economic teaching conform to the universal law of compensation? It can be made plain to all that a man cannot safely consume more than he produces, for the law of the conservation of energy is as exact in its operation in the field of economics as it is in physics. I see no reason why these basic facts of economy cannot be taught by analogy to every one. When they are understood, men will concentrate their organized efforts upon creating an environment which will make work a joyous thing and stop trying to get away from it as so many are now doing. The question of producing what we need for the full enjoyment of life will then be a long way toward being solved. For we will then make the work by means of which we earn our livelihood, a source of joy and inspiration. The illustrations will, I hope, give you a hint of how this can be accomplished, even as industry in the main is today constituted.

Does not the reason that the average employer is opposed to labor unions lie in the fact that he is afraid that the restrictions which he thinks the unions seek to impose will take away his own opportunity for self-expression by preventing him from working out his

7

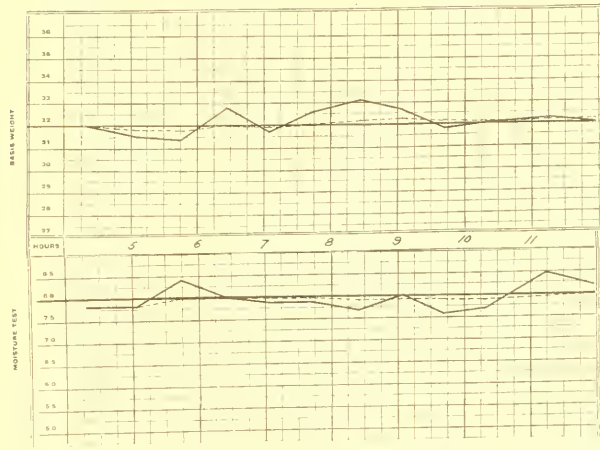
TOUR NO. 3 MACHINE NO 1 MACHINE TENDER BENNETT DATE May 10 1918



PROGRESS RECORD		
Items	Day	Period
Weight	89.3	88.3
Moisture	97.3	93.2
Uniformity	81.1	86.2
Total	89.2	89.2

8

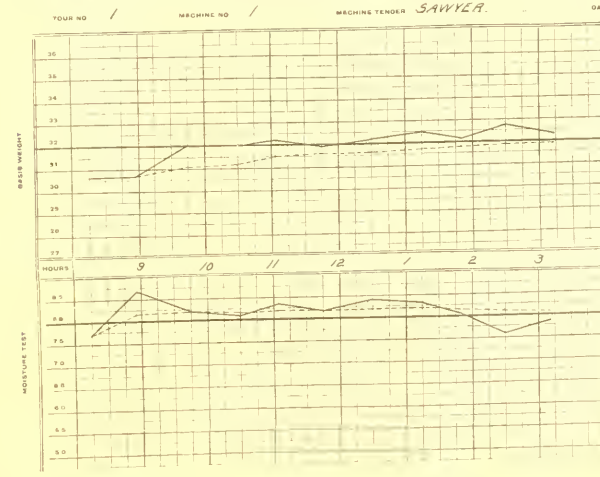
TOUR NO. 2 MACHINE NO 1 MACHINE TENDER TAYLOR DATE May 10 1918



PROGRESS RECORD		
Items	Day	Period
Weight	92.0	90.9
Moisture	94.4	91.3
Uniformity	85.2	84.5
Total	90.5	88.9

9

TOUR NO 1 MACHINE NO 1 MACHINE TENDER SAWYER DATE May 10 1918



PROGRESS RECORD		
Items	Day	Period
Weight	91.1	91.2
Moisture	92.7	88.2
Uniformity	86.9	87.2
Total	90.2	88.3

PLATE IV

individual problems in his own way? Furthermore, if the unions can demonstrate, as they have in our plants, that this fear is unfounded, but that on the contrary their united cooperative effort helps to develop *esprit de corps*, would not this antagonism on the part of the employer disappear?

Now let us examine further the sheet which gives these progress records. The standard of weight being 32lb, we mark this 100, using the same basis of marking as is used in any other educational institution, 1lb heavy and 1lb light being marked 80.

As with the "Total Weight" we naturally must carry an average to date on this record. How this is done, can be readily understood from the entries and needs no explanation. The same method is used for marking the "Moisture Records," except that in this case we mark 8 percent moisture content 100 and 1 percent more or less 80, the average to date for the shift being cumulative also.

Finally this figure is entered up under "Day" in the progress record attached to the graphical charts. This, together with the cumulative weight record, forms the record for the day (the two being averaged). These sheets are checked up by the research department to make sure that they are free from errors, as the men have no confidence in records they feel are not accurate. The chart on the bottom of the sheet is then torn off and the three for each machine (one for each shift), are posted on a bulletin board in the machine room. The record having the best period average appears first, as indicated on the accompanying charts. (See Plates II, III and IV.)

The period is four weeks and the average to date begins all over again at the end of each four weeks' period. The reason for indicating the standing of the men on a period average rather than the day's average is that it tends toward greater continuity of effort, which is a source of much greater satisfaction to the workman. It is the steady progress that really counts and not the spasmodic, spectacular high record for any one day. *The record, to give joy to the worker, must reflect the constant, steady inner urge which indicates the degree of his mastery of the forces he controls in the day's work.*

The improvement in the records from October 16 (made about a week after the recording commenced) to November 27 is very noticeable. The records of May 10, however, show how completely the men became the masters of the machine. From the first three records (of October 16) it is evident that the machine was more or less controlling the men who really formed a part of it. In the last three records (of May 10), however, the machine was completely under control and was literally an instrument for expressing the degree of the man's mastery of the science and art of making paper. The difference is enormous!

The three sets of records of the same machines, and machine crews, on three different dates show the actual results obtained, and I would like to call your attention to the last three of May 10. (See Plate IV). You will note that while at first there was quite a range of difference between the men, that on May 10 the records were 89.2, 88.9 and 88.6 respectively. This shows very clearly that the spirit of friendly rivalry and competition will increase rather than diminish, if only the progress records are made interesting and do reflect the quality of the work. The old idea that competition in the sense of making money is the mainspring of every man's activity, is passing out, for we are realizing that the possessive instinct which economists over emphasized in the past is giving place to the creative instinct. Competition from the purely moneymaking sense is not the life of trade, but rather the reverse.

We do not pay a man more money for a good record but pay the prevailing union scale for all positions in our plants. These are adjusted each spring by joint conferences with our men. In this way we keep a proper wage balance between the different classes of work in proportion to the skill required and as a consequence avoid all the innumerable difficulties which confront the piece work system, task and bonus plan and all other direct payment methods. It is often argued that it is not right to pay a good man the same rate as a poor man and to this I absolutely agree, but the fact is that when these progress records are furnished to men, all men in a certain operating class finally come to be practically equal in performance and the differences will be only between the amount of skill required in each different class of work and in these classes there *is* a difference in compensation. Proof of this statement is brought out by the three records of May 10; but for those who do not wish to take so few examples as conclusive, I would like to say that it has been my experience that invariably the competition is keen enough on all quality records to bring nearly all men, (who have been at the work a sufficient length of time to become expert) practically to the same degree of proficiency.

Every organization should encourage its employees to progress from one class to another, so as to have as many "all-round" men in its employ as possible, and it has been our experience that you can practically always convince a man who asks for more than his particular job is worth, that the way to get more pay is so to master his own job that he can be promoted to a higher class. Men have confidence in a company where promotion from the ranks is the rule.

Perhaps some principle of paying men an increase of a certain amount per hour for each month's continuous service can be worked out between certain maximum and minimum rates. A man would then start in at a fixed minimum per hour and advance automatically to a maximum rate representing the value of his particular occupation as decided upon in joint conference between the employer and employee. This principle is not new in unionism, and is even now operative in some trades.

You will notice that on the record of May 10 there appears a "uniformity record" which was not on the records of October 16 and November 27 (although for the sake of explaining its method of computation it was shown on the large record sheet). This was added because the machine tenders themselves wanted us to find some way of measuring how near they came to having the weight across the sheet uniform. The third column marked "Uniformity Record" (Plate 1) previously referred to, shows how this record is kept. It will be noticed that the three weights are 30.75, 29. and 28.75 the front, middle and back of the sheet, respectively. In obtaining this uniformity record, we take the middle weight as the normal, to which the other two are referred, and for each ¼lb from the normal (not average) we take off 10 points. In this case 29 happens to be normal, therefore,

30.75 =	30
28.75 =	90
	—
Total..	120
Average	60

You will notice we have kept a number of other lines in the progress record attached to the charts. We did this realizing we would be sure to have requests from our men for other factors which they would like recorded, and while we have not had time to work them out as yet, we have already had a number of suggestions. We find that the greater number of factors or laws that we record, the greater

Form M-1. BACK TENDERS MOISTURE RECOR.

Date Nov. 30, 1917

No. 1 Machine.						No. 2 Machine.				
Name	Moisture		Progress. Record.		Name	Moisture		Progress Record.		
	Day	Period	Day	Period		Day	Period	Day	Period	
JOANIS	7.9	7.7	94.1	94.2	FRENCH	7.7	7.8	92.7	93.1	
McCLELLAND	8.3	7.8	82.7	83.8	ANDREWS	7.4	7.5	81.8	80.2	
BEAUDOIN	7.9	7.6	89.3	83.5	TALLON	7.4	7.2	84.2	78.9	

is the interest in the work, because it brings to bear upon the problem a greater amount of thought.

The "basis weight" and "moisture test" records had only been operating a short time when the machine-tenders called our attention to the fact that they could get better results if the stock thickness or density furnished them by the beater room was more uniform. They asked us to find some way to measure the thickness of the stock so that the beater engineer could do his work more intelligently. As a result of this suggestion and after discussing the matter with the beater engineer, our research department has tackled the problem of measuring this stock thickness and it is now practically solved. The beater engineer immediately suggested to us that the variation in the stock thickness which was furnished him by the sulphite pulp mill and groundwood pulp mill was not uniform, and that we should find some way of recording the thickness at these points. We found that to do this we had to increase the amount of agitation in the pulp storage tanks, and as a result are making some radical improvements which will tend to produce greater uniformity throughout the entire process. Right here it might be well to call attention to the fact that our experience has been that men do not have to be stimulated to make suggestions by offering prizes. They are glad to suggest improvements, for in this way they are helping to create conditions in the plant which help them to get better results (the results being indicated by their progress records). Then, too, they are sure to receive recognition for their suggestions, for the foreman knows our judgment of his ability depends largely upon how he succeeds in getting his men to use their brains. He naturally hastens to give credit for all suggestions made. Of course, it goes without saying that this greater uniformity is bound to result not only in a better quality of paper, but in increased output as well; in fact our Sturgeon Falls mill, without making any changes in the speed of the paper machines, has already increased its output over 5 percent as a consequence of more uniform operating conditions.

Form M-1. BACK TENDERS MOISTURE RECORD

Date May 10, 1918

No. 1 Machine.						No. 2 Machine.				
Name	Moisture		Progress. Record.		Name	Moisture		Progress Record		
	Day	Period	Day	Period		Day	Period	Day	Period	
FORTUNE	8.0	8.0	97.3	95.5	JOANIS	8.0	7.9	97.5	92.1	
McCLELLAND	8.1	7.9	92.7	92.0	ANDREWS	7.9	7.8	95.0	91.9	
MARCHILDON	8.0	7.8	94.4	90.2	FRENCH	8.0	7.8	95.6	91.8	

We have further made the discovery that what we call the slowness or freeness of the stock has quite a bearing on the quality of the paper as it comes off the paper machines, and as a result we adopted a method which would record this slowness and freeness. By free stock I mean stock that the water leaves rapidly and by slow stock a stock which the water leaves slowly. We found incidentally that this slowness and freeness is one of the best indexes of the quality of the groundwood pulp, and we are now working upon a series of factors which will record the operations of the grinders upon which the wood blocks are reduced to pulp. This work has always been one of the most uninteresting and monotonous jobs in the plant, but from the small amount of work we have already been able to do, we find increasing interest upon the part of the worker, and I feel free to prophesy that when these several factors have been recorded, we will convert this into one of the most interesting jobs in the plant. I base this prophecy on my previous experience at the Burgess Sulphite Fiber Company where we recorded hundreds of operations. These records we found to be grouped under three general classes: *quantity* records, *quality* records and *economy* (or cost) records. Quality records (which occupy the middle position), are, perhaps, of the greatest importance for they bring the individual's intelligence (brain power) to bear upon the problem and as a consequence by removing the obstacles to uniformity of quality, remove at the same time the obstructions to increased output. The creative power of the human mind is, however, not content simply to produce the best quality under existing conditions of plant operation. So the desire to create new conditions for the more highly specialized working out of the natural laws of the process, demands expression and this expression at once takes the form of suggestions for improvements in mechanical devices.

This desire contains within it the germ of economic thought which will unfold and express itself eventually in a request for cost records, and the organization that neglects its opportunity to satisfy this desire is overlooking one of the great avenues leading toward intelligent productive effort.

Because of the interrelation of Quality, Quantity and Economy records, any complete record of individual progress must, of course, take them all into account. However, as this is not always practical we have at least one of three ways of measuring progress always open to us.

As further illustrating the necessity for giving individual records to the men, we discovered that the backtenders who sometimes work on other shifts than their regular ones lost interest in their records to a certain extent when on a different shift and, therefore, a request came to keep the backtenders' records separately, so that no matter what machinetender he happened to be working for, his record would follow him. This was done, and the two records of November 30 and May 10 reproduced herewith, show clearly not only the gains made but the increasing competition for a good record. I would like to say that other factors under control of the backtenders have been already suggested for recording, and these we are planing to work upon as soon as our Research Department has had time to develop a plan.

We had an interesting experience with one of our backtenders which illustrates how men appreciate these progress records. At Sturgeon Falls we have two small 120 in. machines. At Sault Ste. Marie our narrowest machine is 164 in. and the widest 198 in. Whenever we have openings on these wide machines, which pay more money for backtenders, we like to advance our own men. One of our men went from Sturgeon Falls to the "Soo." His machinetender, who told me the story, said he noticed this man ran his paper much more uniformly than any backtender he had ever had as regards moisture test. Upon inquiring where he had learned to run paper so uniformly, he explained that it was at Sturgeon Falls, where they had a "scheme" for letting backtenders know just what the moisture was every time a reel was changed. He said the scheme was "great" and he hoped they would start this same thing at the "Soo."

I referred to the fact that mistakes in records cause a lack of confidence. It may interest you to know how we overcame this trouble by giving "accuracy" records to the "sample tester." This was done by having the Research Department check over the number of mistakes made each day in the "reel record" sheets. A perfect score with no mistakes we call 100; 2½ points were taken off for every mistake. An average of eight or ten mistakes a day was a common occurrence and almost immediately this changed so that today a mistake is decidedly the exception rather than the rule.

At the Burgess plant (and we are now developing the same system at our Canadian mills), the same principle of developing the individuality of each man was extended right up to the department heads, who have complete records including cost sheets of the operations of their departments. We also developed a system of reports for the maintenance and construction crews by giving the men records showing the cost of jobs that they were working on, together with detailed figures of the cost of all the materials they were using. The saving, because of the creative power released, through the aid of these records, was enormous, and the fact that our men did this for us without being paid on a piece-work system, or a task or bonus plan, demonstrates, it seems to me, conclusively that men instinctively desire to do the right thing, and do not have to be bribed (as a workman once expressed it to me) to do good work. It is unnatural for men to work in a negative and destructive manner and the fact that so much of this sort of work is done is not so much a reflection on the individual workman as it is upon the manager who has failed to create an environment in which a man can work intelligently.

Is it not, perhaps, unfair to the workman to hold the "almighty dollar" constantly before him and thereby stimulate his selfish instincts? Our experience at least has demonstrated that it is better to reward merit by promotion and to pay a regular hourly rate of wages; then by means of progress records to help him measure the result of his efforts in such a manner that he is consciously increasing his knowledge of the work. There will be no lack of cooperation in the plant where these principles are used, for goodwill which is based on knowledge will build up an *esprit de corps*, which is not a purely emotional thing that may disappear "over night." It is rather a spirit which recognizes consciously the universality of law and the stability of things generally.

Of course, such vital questions as steadiness of employment, cost of living, and justice in division of

profits—the public included—must be solved. The solution, however, requires democratic cooperation between employer and employee and the elimination therefore of every form of paternalism. The workman must have a chance to express his individuality, and the degree of conscious self-expression which he can attain is in direct proportion to the ability of the organization to measure, for his benefit, the impress of his personality upon it. The most democratic industrial plant, therefore, is the one which permits the fullest amount of individual freedom to each member, irrespective of his position and, at the same time, is so sensitively adjusted that it reflects immediately the effect of his actions. If his actions result in injury to others he will see that, as a part of the whole, he himself must also suffer. An organization of this kind can never be used by the employer to exploit the employee, for it will be continually demonstrating to both that the success of any one part of the organization is absolutely dependent upon that of every other part, and therefore upon the success of the whole.

In conclusion I would like to call your attention to the fact that the great life movement (which brought industry into existence) is not to be recognized in its stationary aspect, i.e., as it is crystallized into the forms of things which we can possess, but in its working, moving aspect that constantly tends toward a fuller, and more complete expression of life. To be conscious, however, this expression must at the same time be individual, so in its working through humanity it can only come to its highest state of development through self-expression, i.e., by release of individualized creative power. This is the reason why, as our knowledge of the great forces of nature increases, we desire more and more to express this knowledge in the creation of conditions (or particular situations) in which we can observe these forces in action, and especially where this action records the degree of our mastery of the law.

As we come into a consciousness of the unity of all life, and see the expression of this unity in the universality of the laws of nature, we know that freedom to express this knowledge in creative work is the only real freedom.

Have we not a right then, to assume that the possessive instinct, which has caused so much unhappiness in the past, is influencing our lives less and less each day, and that the creative, which is the impulse back of all healthy growth, is coming to be more and more the quickening influence, not only in the lives of our leaders, but also in the lives of the workmen as well?

Discussion of Mr. Wolf's Address

Afternoon Sitting

Thursday, May 16, 1918

HENRY P. CARRUTH, President, in the Chair.

After the meeting was opened, the secretary announced a paper by Otto Kress and George C. McNaughton on "The Effect of Varying Humidities on the Strength of Fiber Board and its Component Plies," which he recommended to be read by title, unless there was time later in the afternoon. President Carruth then introduced Robert B. Wolf who addressed the meeting on "Results Obtained in Recording of Operations on Paper Machines," his remarks being illustrated by stereopticon views of progress records, charts, curves, etc. The revised text of Mr. Wolf's address is published in this issue as a separate article. The discussion which followed the exhibition of slides is reported below, as follows:

MR. FLETCHER—You raised a point there where you called attention to the fact that the men were far apart at the beginning and close together at the end. That struck me as very interesting. Naturally the men were working for a good record. Now, as a man goes off a shift, he usually does not inform the man that follows him of the condition of the machine. All of us who handle machines know that there is quite a variation; that it takes a few minutes for you to pick up information regarding the condition of the stock. Now, if the men could realize the service they might render by informing each other, they would keep themselves in closer touch with the work, and if this was done on all three shifts it would improve operating conditions. Unfortunately this friendly spirit does not ordinarily exist. How do you find it where you keep these records?

MR. WOLF—We found, Mr. Fletcher, that when we changed our records from a *quantity* to a *quality* basis that we always got a friendly spirit of rivalry instead of an unfriendly one. It is not exactly what you would call a "sporting spirit," but the kind of spirit which enters into a game which requires brain power. The competition which results has in it most decidedly the element of fair play, which is usually lacking where the competition is on the basis of physical production only.

TOM HARVEY—How often do you take the samples for records of weight and moisture?

MR. WOLF—They are taken every time a reel changes; that is about every thirty-five minutes.

MR. HARVEY—Through the entire twenty-four hours?

MR. WOLF—Yes; we have a man on each shift for every two paper machines. As mentioned previously, these men are members of the labor organizations; naturally there is no feeling that we have some sort of a "follow-up" system but that the entire function of the records is to give more information to the machine crews in order to enable them to do their work to better advantage.

(A member made inquiry at this point regarding the control of the moisture test, but the exact phraseology of his query could not be made out by the stenographer.)

MR. WOLF—Personally, I do not approve of automatic regulation of stock going to the paper machines unless it saves men. I think it is much better to give the man a chance to control the machine than to have it automatically controlled for him.

A MEMBER—I mean the drying end.

MR. WOLF—It seems to me it is much better if the backtender regulates the drying of paper by hand. Our experience is if we furnish the machine with uniform stock that there is very little difficulty about proper regulation of the drying; in other words, the changes are so gradual and slight that they can be easily controlled. And here again, Why deprive the backtender of the privilege of controlling his operation personally?

A MEMBER—I understood you to say you regulate the density of the stock. Do you do that automatically?

MR. WOLF—We have not started this stock thickness regulation, but are installing two Trimby regulators for regulating the uniformity of the stock in the storage tanks, from which it is pumped to the beaters.

MR. HARVEY—Your process is a comparatively simple one. You are running with just one stuff pump and one stuff box board we have as many as seven machines combined in one, there are seven chests, seven stuff pumps and seven stuff boxes to regulate. It is a well known fact, the thinner the paper we are making, the faster the machine is running, the less variation you will have in weights. Our machines instead of running paper at 24x36—30lb, or for example four one-thousandths thick and running 600 ft. a minute run probably 100 ft. a minute on paper which gauges .030 thick, so we have considerable more trouble in keeping our weights correct than you have on a news machine or book machine and this variation of weight is probably caused by the variation of the density in the stock. Is it possible to regulate the density of that stock automatically?

MR. WOLF—Yes, absolutely. Mr. Rhodes of the International Paper Company, who is here, I believe has had some experience with this regulator. Would you kindly tell us about it, Mr. Rhodes?

MR. RHODES—I don't see why the regulator that Mr. Wolf is speaking of wouldn't operate the same for board machines. Do you use a weight regulator on the machine?

MR. WOLF—No, we have not used weight regulators on our machines.

MR. HARVEY—We furnish them three or four different kinds of stock.

MR. WOLF—One man runs all kinds?

MR. HARVEY—Yes.

MR. WOLF—Why not have a different standard to work to for each order, calling the normal weight or the weight desired 100, varying the moisture test in accordance with requirements; for instance, our standard on hanging paper instead of being 8 percent moisture is 6 percent.

MR. HARVEY—What I am getting at, the variation of the weight and thickness of the paper, depends more on the beater man than it does on the machine man, and if we can to regulate the weight on your machines. In making box get away from that variation of the thickness of the stock and variation of beating conditions we can practically eliminate all our trouble as regards variation in weight.

MR. WOLF—There are instruments on the market to record the beating operation. I believe one invented by the Eastern Manufacturing Company and the other by Mr. Green, formerly of S. D. Warren & Company.

A MEMBER—We had great difficulty in getting the stock to a proper density in order to measure it out in the right proportion.

MR. WOLF—I understand the Eastern Manufacturing Company solved this problem by putting all of their halfstuff in centrifugal machines which brought it to a constant density.

A MEMBER—That is what we are doing now. We then have a record which enables us to get correct results. We used a centrifugal pump to work up the stock; that didn't work very well. The regulation of the beater is the proper thing.

MR. WOLF—We have so far not had occasion to record this operation along the lines you mention.

A MEMBER—How about one man leaving his shift without leaving complete information as to what has happened for his running mate? Will these records help you in this?

MR. WOLF—They do. We find when these quality records are posted that men are always careful to leave full information for those who follow them on the machines. It may interest you to know that these records are all finally plotted together on a big record sheet which enables the shift foremen to compare the results of their shifts. We also keep individual records of each machine which enables us to correct mechanical difficulties when the records show that these exist. The whole idea of this grouping of individual records is to get shift and department records which will reflect the individual progress of the group as well. Our progress records as a whole have increased from the original figure of about 70 to something over 90. All these records are available to any man in the organization.

MR. CARRUTH—I would like to inquire if you have attempted to record operations where the records are based on appearances and decided by the personal judgment of the "sample tester." For instance, take the question of finish or formation. This may vary so much as

to completely dry a sheet and yet so far as I know there has not yet been developed a means of measuring it.

Mr. Wolf—We have not worked on this problem but are planning to do so, as it is an important factor. I believe, however, that it will be solved as soon as sufficient study has been put upon it. Whenever records are kept, however, it should be borne in mind that they should be based upon something exact and not mere personal opinion; otherwise, the men will not have any faith in them.

Mr. Obermanns—I understand that the record of the machinetender is based or determined by his paper weight and the moisture. How do you ascertain the moisture content? It necessarily must be a very fine instrument to determine accurately the moisture content of a sheet of paper.

Mr. Wolf—In order to get more accurate results of the weights, we were obliged to design a much more delicate scale than was on the market. The scale we are using is very far superior to the German quadrant scale and was designed by Dr. Thwing of the Thwing Instrument Company, Philadelphia.

A Member—How long does it take to make the moisture test?

Mr. Wolf—Fifteen minutes. It really only takes ten to dry out, but we allow fifteen to be safe. Perhaps Mr. Shipman will explain the proceedings in detail.

Mr. Shipman—We at first attempted to use a scale where a balance is effected by moving a small rider back and forth on a beam. We found that the sensitiveness of such a scale was insufficient for our purposes inasmuch as, no matter how conscientious the operator, weights varying by as much as half a pound could be obtained on the sample of paper.

We then decided that we should have some sort of direct reading scale. The so called quadrant scale is not sensitive enough to allow for moisture determinations. By this, I mean we decided in order to save time in the manipulation to use the wet and dry basis weights for calculating the percentage of moisture in the paper. A simple calculation will show that if either your wet or dry basis weights are in error by as much as half a pound that your moisture determination will be in error by over 1 percent. Inasmuch as your total range of moisture content is only from around 6.5 percent to around 9 percent an error of 1 percent is not allowable.

It was necessary therefore to design and build an entirely new type of direct reading scale whose readings should be sensitive to one-tenth pound basis weight.

We have five of these scales in constant daily operation and they are giving very good satisfaction, being both fast and accurate.

With regard to the drying of the samples of paper for moisture determination, the problem was to be able to dry six sheets of newsprint 24x36 inches and do it in fifteen minutes since the reels were finished in about that time on the paper machines. The oven is an ordinary galvanized iron box, heated with two layers of ¾ inch steam coil to a temperature around 240 Fahr. The air in the machine room being too damp to fully dry the samples, we built a small brick chamber, set the oven on top of it and ran a pipe from the bottom of the chamber to the finishing room taking our air through this pipe. In order to make sure that our air was sufficiently dry to carry off the moisture quickly we built a shallow box, twelve feet long, divided into two compartments one over the other, filling each compartment with quicklime. The air for drying the samples is drawn through both these compartments and dried by contact with the lime. It is then blown by a small 2 inch direct-connected blower to the brick chamber underneath the oven. In the [illegible] straight air pressure is always maintained on the oven so that no damp air from the machine room can enter the oven through the cracks around the doors. An outlet on the brick chamber allows for readings with wet and dry bulb thermometers to indicate when the quick lime has been spent in its absorbing power.

The above air-drying apparatus was installed at only one of the plants and tests are being made with it to determine whether it is necessary to employ such an apparatus. This point is not yet fully determined.

(At this point a slide showing the scale was thrown on the screen.)

Mr. Klund—With a system of this kind based on the records of the individual machines, do you find that any jealousy exists between tenders of machines that may be side by side? In our own mill the tenders of adjoining machines are expected to assist each other in case of trouble.

Mr. Wolf—I can only give you the results of our actual experience. We never have any of these jealousies which cause hard feelings when the records are on a quality basis. I believe, as I have said before, that *quality* stimulates the intellect, whereas *quantity* does the physical or lower animal nature. A man instinctively begins to realize that only as he cooperates with his fellow man can he have the greatest possible amount of freedom for his individual development. This conception comes to him through the use of his intellect and for this very reason the quality records which stimulate the intellectual faculties are bound to produce in him a larger social consciousness which makes him less selfish and more anxious to cooperate in a larger way for the benefit of the whole. When the man in the groundwood mill becomes conscious of the trouble he is causing a man in the beater room if he doesn't run his stock uniformly, he naturally is more careful, especially if the care that he exercises is being recorded for him in the progress record. This is also true of the man in the beater room when he becomes conscious of the effect of his work upon the machinetender. A spirit of unfriendly rivalry simply cannot exist in a plant where the "will of man" is operating in this conscious manner.

(This brought the discussion of Mr Wolf's paper to a close, and after making a few announcements regarding registering, etc, Chairman Carruth called upon George E. Williamson to present his paper on "Modern Methods in a Paper Mill Boiler Plant."

discussion of boiler plant methods

The following discussion of Mr. Williamson's paper, then ensued:

(The text of Mr. Williamson's paper will be found in Paper for May 22, 1918.)

Mr. Kress—The gentleman who was to open the discussion asked me to take his place. There is hardly anything that I can add, and I would like to say that Mr Williamson's paper is now open for discussion.

J. H. Wright—In getting your records of CO_2 gases, do you employ a recorder?

Mr. Williamson—We do not have a recorder. We had an old style recorder, which became a nuisance. We have now an ordinary hand sampler and collector, and we have pipes running from each boiler uptake to our control board.

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The Yellowing of Paper[1]

A Study of the Causes or Principal Factors Producing the Yellowing of Paper

By ALFRED B. HITCHINS, Ph.D., F.C.S., F.R.M.S.

A NUMBER of experiments have been carried out to determine the causes or principal factors bringing about the yellowing of paper. In this work handmade sheets were used, made from the finest picked white rags, and the chemicals used were all of c. p. quality, tested carefully for impurities and where necessary further purified. Particular care was also taken in the bleaching and washing of the stock, as it was realized that this in itself might have an influence on the yellowing of papers. The sheets were subjected to three test conditions.

Test No. 1—Exposure to arc light for one hour to 100 hours. Samples withdrawn at 10-hour intervals.

Test No. 2—Exposure to moist heat, 90° Cent. in a constant temperature oven in total darkness for 1 to 100 hours. Samples withdrawn every 10 hours.

Test No. 3—Exposure to dry heat 90° Cent., heated in a constant temperature oven in total darkness from 1 to 100 hours. Samples withdrawn every 10 hours.

It was thought desirable that as much as possible, only one side of the sheet should be acted upon, so the samples intended for exposure to light were sealed down to an opaque backing, and the sheets intended for exposure to heat were sealed down to thin asbestos boards. No filler was used for any of the experimental sheets. In this investigation the yellowing of paper due to the fading of dyes or the presence of woodpulp is not considered, all the sheets having been made without any dye.

For the charts used to illustrate the data obtained, the following nomenclature has been adopted: The ordinates headed Y° are degrees of yellowing. The abscissae represent hours of exposure. The lettering of the curves—A, B and C correspond to tests Nos. 1, 2 and 3—*viz.*: light, moist heat and dry heat. The degrees of yellowing were measured photometrically by means of a calibrated yellow wedge.

The sheets for experiment No. 1 were made without size and after subjection to the test conditions showed practically no yellowing.

The sheets for No. 2 were prepared with three different amounts of rosin—2½ percent, 5 percent and 10 percent. The result of the exposure to the test conditions is illustrated in Fig. 1. Evidently the degree of yellowing is dependent upon the amount of rosin present.

The sheets for experiment No. 3 were prepared with the same amounts of rosin, but with the addition of 1 percent, 2 percent and 4 percent of iron to the alum. The results obtained are shown in Fig. 2.

For experiment No. 4, sheets were prepared with the same amounts of rosin and iron with the further addition of 2½ percent, 5 percent and 10 percent of gelatin. These results are shown in Fig. 3.

The alum used to precipitate the rosin in all cases was iron-free alum, so that the effects of the different amounts of iron added could be observed.

A consideration of the results obtained leads to the conclusion that however carefully the paper is prepared, the addition of rosin alone as a sizing material will, in the course of time, produce yellowing. Also that the presence of iron is a very important factor. The curves shown in Fig. 2 are all considerably higher where iron is present and the degree of yellowing is more or less proportionate to the amount of iron introduced. It is generally conceded that an animal-sized paper will yellow more than one which is free of gelatin sizing.

The result shown in Fig. 3 where definite amounts of gelatin were added bear this out very thoroughly. As the amount of gelatin is increased, so the degree of yellowing is increased. The form of the curve where gelatin is present is, however, of rather a different character. There is more or less of a tendency for a maximum amount of yellowing to take place within a given time, after which further yellowing is very slow or does not occur at all. It is obvious that light is the most important factor in the yellowing of paper. Next in order of importance is moist heat, and the least active of the three factors is dry heat. It is quite in keeping with theory that light should be the most potent factor in connection with the yellowing of paper. Rosin alone is to some extent sensitive to light, and rosin and iron compounds are undoubtedly very sensitive to light. The addition of gelatin also increases this sensitiveness to light action.

It is possible that the presence of gelatin acts as an organic sensitizer in a manner somewhat analogous to its influence on the formation of a true photographic image. Microscopic sections were cut of the various samples of paper so that it was possible to examine the internal structure. In the case of the paper containing only rosin size, it was found under the action of light that the yellowing produced was only superficial, the interior of the paper being hardly discolored at all. Under the influence of heat the discoloration extended more deeply. In the case where iron was added in known quantities the discoloration penetrated a little more deeply into the structure and where the paper was gelatin-sized in addition to the rosin and iron, the sheet was almost equally yellowed throughout. This also tends to prove that the gelatin has the power of acting in the manner of an organic sensitizer.

A general consideration of the data obtained confirms the work of Klemm, Zschokke and Schoeller, that the yellowing of paper is due to the formation of rosin-iron compounds, and that the amount of such compounds definitely determines the amount of yellowing to be expected. Schoeller has stated that in cases where the size is extracted early from samples so as to remove the yellowing compounds the paper will retain its original color. A number of the sample sheets were freed of rosin and subjected to the tests before described, in connection with the sheets made for experiment No. 1—*viz.*: without size. It was found that the sheet from which the sizing had been removed did not discolor greatly, but did not hold up as well as those which had never been sized at all. The rosin size, even if it is present in the paper only for a short time, undoubtedly has some influence upon the fibers and produces a certain amount of yellowing with time.

Where it is necessary that a paper retain its original color, it is obviously important to use as little rosin size as possible, consistent with the degree of sizing required, and to use always an iron-free aluminum sulphate as the precipitant. The animal sizing should be omitted or kept as low as possible.

[1]Communication from Ansco Research Laboratory.

Graphs Illustrating Dr. Hitchins's Article on the Yellowing of Paper

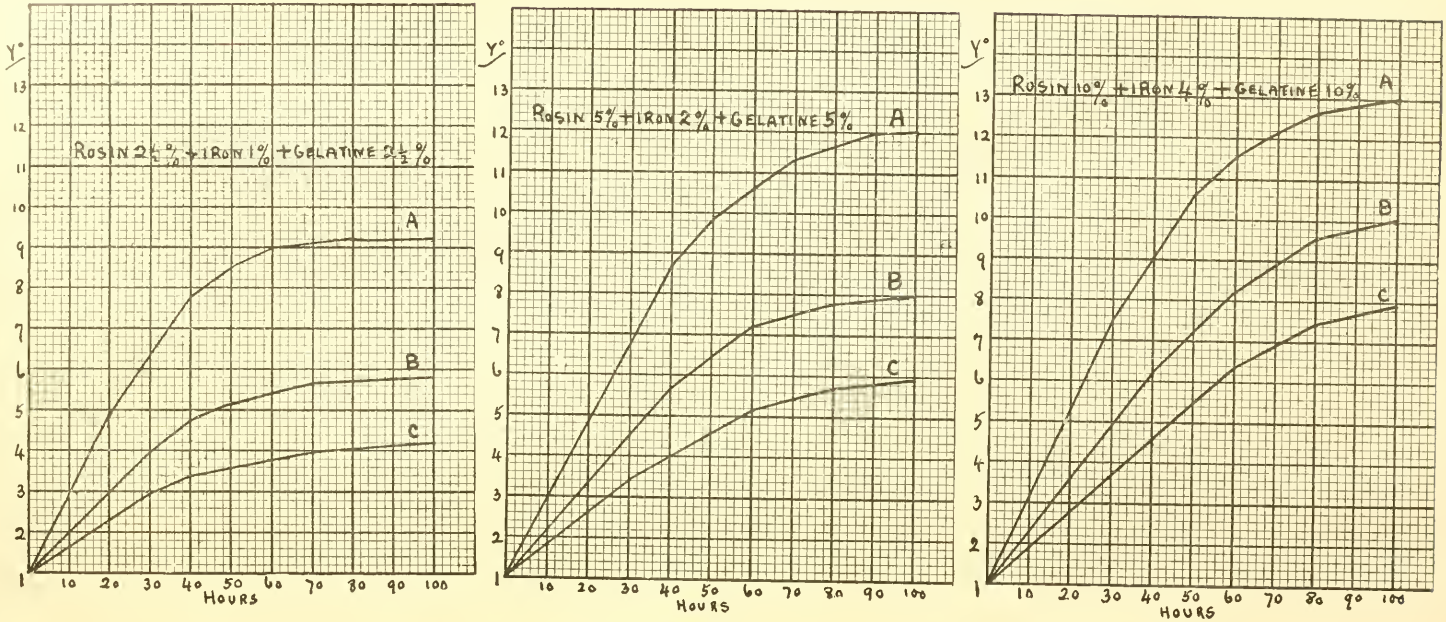

FIGURE 3

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